GLOBAL EXPANSION TECTONICS

Modern data analysis smashes the theory of plate tectonics by suggesting that the Earth has been expanding since Archaean times, particularly since the Early Jurassic period.

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There is nothing more contentious in global tectonics at this time than the expanding Earth concept. — Owen, 1992

Global tectonics was introduced a number of decades ago as an all-embracing science that seeks to quantify and explain the Earth as a dynamic, interactive entity. As an outcome of this new philosophy, we, in all our walks of life, have become accustomed to viewing the Earth globally, whether in relation to geology, ecology, climate, population, politics and so on.

Global tectonics, however, in its strictest geological sense, has become synonymous with plate tectonics, where all continents move across the Earth's surface under the action of mantle-driven convective currents. Each of the continents is supposedly in a state of random motion, periodically colliding, amalgamating, breaking up and dispersing during Earth history.

Global Expansion Tectonics is presented here as a viable alternative global tectonic explanation of geological phenomena, where the Earth has been expanding since the Archaean aeon and continents break up and disperse due to crustal extension, in an orderly, pre-determined manner. In making this statement, it must be realised that the concept of Earth expansion is not new; only the technology available to quantify an expansion process is. The global geological and geophysical information available for Earth dynamic studies has only now reached the stage where all global tectonic hypotheses, including plate tectonics, can be confidently quantified, challenged or discarded.

Earth expansionists, since the pioneering work of Christopher Otto Hilgenberg (1933) and, more recently, Professor Sam Warren Carey (1956, 1976, 1988, 1996) and Klaus Vogel (1983, 1990), have known that if all Earth's continents were fitted together they would neatly envelop the Earth with continental crust on a globe some 55% to 60% of its present size (the present mean radius of the Earth is 6,370.80 kilometres). This coincidence led Hilgenberg, Carey, Vogel and others to conclude that *terrestrial expansion brought about the splitting and gradual dispersal of continents as they moved radially outwards during geological time*.

However, this coincidence has consistently failed to gain recognition within the scientific community as a viable explanation for modern global tectonics. The primary reason for this non-acceptance in the past is considered to have been the lack of supportive global-scale evidence to quantify a reproducible expansion process with time. At present, scientists are so engrossed in forcing observational data into a singular plate-tectonic model that they are blissfully unaware that consideration of such a coincidence is necessary.

It has only been during the past two decades that global-scale data gathering, computer processing capabilities and electronic communication have advanced sufficiently enough to maintain and publicly distribute geological and geophysical data. Global Expansion Tectonics utilises this modern data and is introduced here as a revitalised concept of Earth expansion, which uses modern oceanic and continental geological mapping to constrain both ancient Earth radius and continental reconstruction from the Archaean aeon to the present. This data was not available to early researchers and, because of this, scientists could not be convinced that modelling studies or conclusions about Earth expansion were anything more than mere coincidence.

By using modern sea-floor mapping, Earth expansion can now be confidently modelled and constrained at reduced Earth radii by a simple process of progressive removal of sea-floor crust back to the Early Jurassic period (the age of the oldest sea-floor crust) and back further to the Archaean aeon by using continental geology.

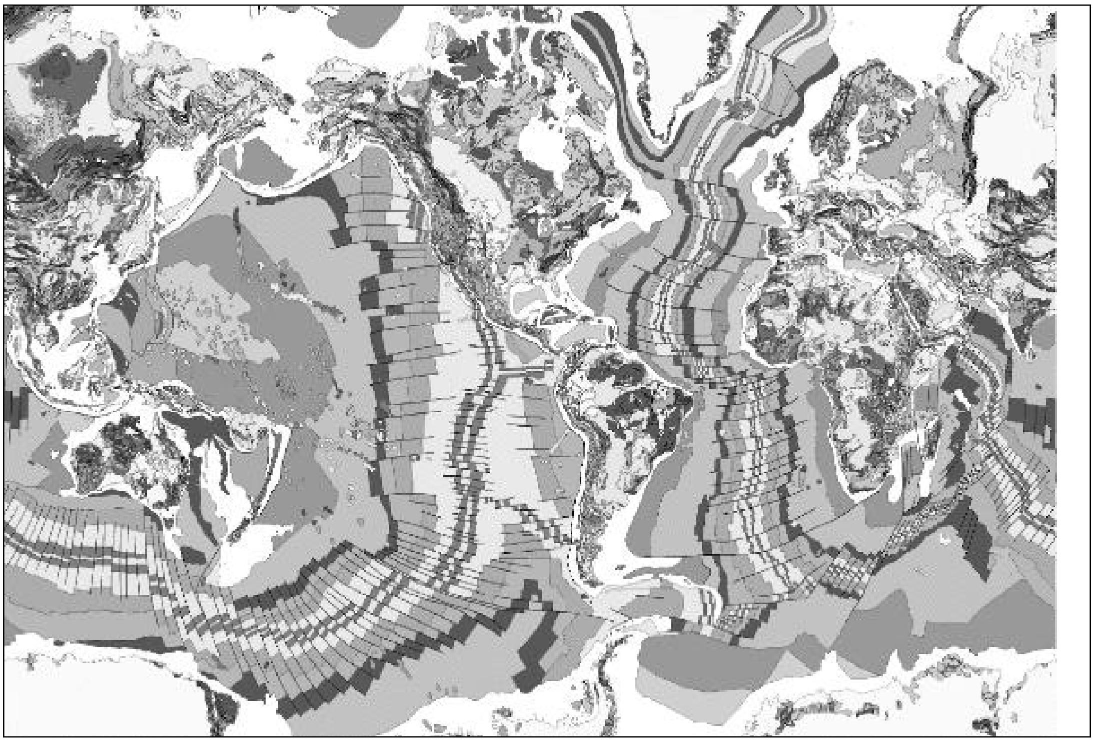

Figure 1. Bedrock geological map of the world showing continental and oceanic time-based geology. Oceanic mapping in each of the oceans represents the main geological periods, ranging from the Recent along the mid-ocean ridges to the Early Jurassic adjacent to the continents. The map is shown to 80 degrees north and south latitudes only. (After the *Geological Map of the World*, published by CGMW & UNESCO, 1990)

GLOBAL EXPANSION TECTONICS

Empirical modelling and investigation into Earth expansion from the Archaean era to the present is based on the published *Bedrock Geology of the World* map (CGMW & UNESCO, 1990) (figure 1). The geology shown in this map is time-based, which means that the continental bedrock geology represents the major geological aeons (Archaean, Proterozoic) and eras (Palaeozoic, Mesozoic, Cenozoic), and oceanic geology represents the geological periods (subdivisions of the Mesozoic and Cenozoic eras) ranging from the Jurassic period to the Recent.

The oceanic geology shown in this map was compiled from magnetometer surveys, sea-floor drilling and radiometric and palaeontologic age-dating over the oceans, carried out during the 1960s to 1980s. Geophysical surveys covering all the world's oceans revealed long, linear, magnetic anomalies in the sea floor that are symmetrical about, and parallel to, mid-ocean ridges located centrally within each of the oceans. These anomalies were interpreted by geophysicists as evidence for sea-floor spreading, where mantle-derived lava wells up along the length of the ridge axes as the central spreading zones are continuously widened. These magnetic anomalies have now been age-dated, and sea-floor mapping based on the magnetic anomalies is shown in figure 1.

The distribution of the oceanic geology demonstrates that all the oceans contain mid-ocean ridges, and distribution of geology symmetrical about, and parallel to, the mid-ocean-ridge axes demonstrates that the sea-floor crust ages away from the mid-ocean ridges, with the oldest Early Jurassic crust located adjacent to the continents. More importantly, the oceanic geology demonstrates that all the oceans are enlarging approximately normal to the ridge axes, and all continents are now moving away from each other as the sea floor enlarges. The current rate of sea-floor spreading in each of the oceans varies between 1 to 10 centimetres per year.

To account for sea-floor spreading in all the oceans, though, we must consider the presumption that either:

(a) the Earth's radius has remained constant throughout geological time, and, to compensate for lava added along the spreading ridges, older pre-existing crust is continuously disposed of along inferred subduction zones located around the Pacific margin, displacing and recycling the crust into the mantle to maintain a constant total surface area, i.e., plate tectonics; or

(b) the Earth's radius has increased with time as lava is added at spreading ridges. In this concept, sea-floor crust older than the Early Jurassic period does not exist, subduction of crust is not required, and an increase in the Earth's surface area is a measure of the rate of change in the Earth's radius with time, i.e., Earth expansion.

To quantify Earth expansion, spherical models of the ancient Earth were constructed by progressively removing sea-floor crust parallel to the mid-ocean ridges and refitting the crust along each mid-ocean ridge at a reduced Earth radius. Each model shown in figure 2, for the Indian Ocean, and figure 3, for the Atlantic

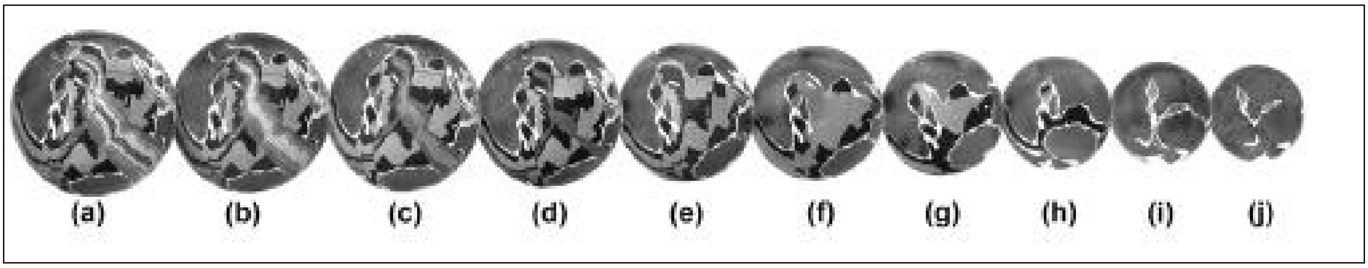

Figure 2. Expanding Earth reconstructions of the Indian Ocean for the beginning of the (a) Recent, (b) Pliocene, (c) Miocene, (d) Oligocene, (e) Eocene, (f) Palaeocene, (g) Late Cretaceous, (h) Mid Cretaceous, (i) Early Cretaceous and (j) Late Jurassic periods. Each ancient Earth model was constructed by progressive removal of sea-floor crust, shown in figure 1, and reuniting plates along each mid-ocean ridge at a reduced Earth radius.

Ocean, demonstrates that all crustal plates assemble with a better than 99% fit-together, and all plates are accurately constrained. This construction method was continued back to the Early Jurassic period, about 160 million years before the present, until all sea-floor crust was removed. At this time, all continents were refitted together, like a spherical jigsaw puzzle, at about 62% of the present Earth radius, or about 3,540 kilometres.

By removing all the sea-floor crust, plus sediments deposited around the continental margins (shown as white margins in figures 2 and 3), all the continents can be united as a single continental shell encompassing the entire Earth at a radius of 50% of the present Earth radius during the Permian period, about 260 million years ago. By progressively removing sediments from continental sedimentary basins, each of the ancient Archaean and Proterozoic regions of the continents can also be assembled as a primordial Earth at approximately 27% of the present Earth radius during the Early Proterozoic aeon, about 1,600 million years ago (not shown in figures 2 and 3).

The surface gravity during the dinosaur era, for instance, is calculated to be approximately half the present value, hence dinosaurs were bigger, longer and heavier than they could ever be on Earth today.

FREQUENTLY ASKED QUESTIONS

Acceptance of Earth expansion as a viable global tectonic process is currently envisaged by researchers from many countries to be thwarted by major obstacles which supposedly *outnumber the evidence in favour*. These opinions are based on outdated research carried out during the 1950s to 1970s, well before the advent of modern global tectonics, computer technology, global data-gathering capabilities and multimedia communication. Unfortunately, these same outdated opinions are being carried through to recent literature without proper scientific investigation, regardless of advances made in Earth expansion.

The most commonly perceived problems include: an explanation for the cause of Earth expansion; the problem of ocean water and atmosphere accumulation on an expanding Earth; and palaeomagnetic determinations of ancient pole locations and Earth radius. Frequently asked questions about Earth expansion include:

• Where does the additional mass come from?

This is a very important but very difficult question to answer. Because the Earth has always been considered as being the same size since creation, from either a religious or a cosmological point of view, it has not been necessary to ask the question. Because the question has not been asked or taken seriously, where the additional mass comes from remains speculative. This question, however, must be asked in the same context as the additional question: where does the mass of the Universe come from? The answers to both questions are synonymous.

Mathematical studies based on modelling research demonstrate that the Earth is indeed expanding because of an increase in mass with time. What this study also tells us is that the mean density of the Earth has remained constant, or near constant, since creation, and, of importance to life on Earth, the surface gravity has been steadily increasing with time. The surface gravity during the dinosaur era, for instance, is calculated to be approximately half the present value, hence dinosaurs were bigger, longer and heavier than they could ever be on Earth today.

The ultimate cause of Earth expansion was considered by Professor Carey (Carey, 1996) to be intimately related to a cosmological expansion of the Universe. He considered that, based on Albert Einstein's famous equation, $E = mc^2$, the creation of mass occurs as a result of a condensation of energy. Professor Carey concluded that matter is being created deep within the Earth's core. While speculative, it is envisaged that matter condensing at the core-mantle boundary would then result in a swelling of the mantle, which in turn would cause expansion of the Earth. This is then reflected at the Earth's surface by continental crustal extension, and when extension reaches a critical stage, as happened during the Permian period, the continents break up and disperse, exactly as we see in figures 2 and 3.

• What about the pre-Triassic?

On an expanding Earth prior to the Triassic period about 245 million years ago, modern deep oceans did not exist. All continental crust was united to form a single supercontinent called Pangaea, enclosing the ancient Earth at a radius of about 3,200 kilometres—50% of the size of the present radius.

Geographical studies show that oceans during the pre-Triassic period were represented by a network of continental seas, with deposition of sediments within continental sedimentary basins masking all evidence of sea-floor spreading. Exposed lands and varying coastal outlines during the Early Palaeozoic era were represented by the ancient Gondwana, Laurentia, Baltica and Laurussia continents, and during the Proterozoic aeon by the

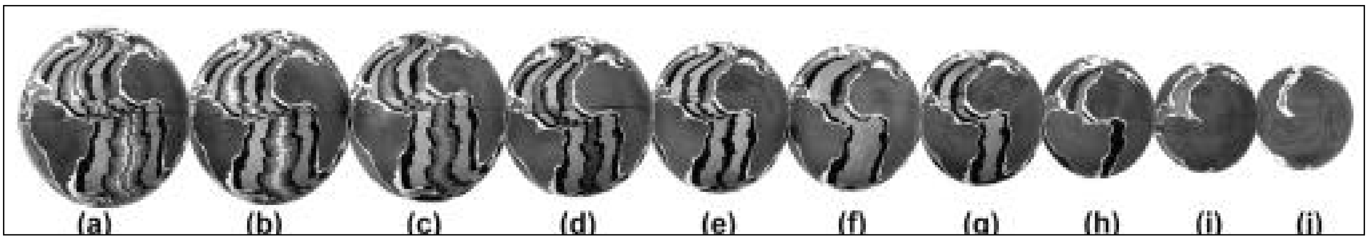

Figure 3. Expanding Earth reconstructions of the Atlantic Ocean for the beginning of the (a) Recent, (b) Pliocene, (c) Miocene, (d) Oligocene, (e) Eocene, (f) Palaeocene, (g) Late Cretaceous, (h) Mid Cretaceous, (i) Early Cretaceous and (j) Late Jurassic periods. Each ancient Earth model shows a progressive break-up and dispersal of continents, resulting in the pattern of sea-floor geology shown in figure 1.

ancient Rodinia supercontinent. These ancient continental assemblages and intervening seas agree in principle with conventional plate tectonic assemblages, without the requirement for extensive ancient Panthallassa and Tethys oceans. The significance to global tectonics is that—without the extensive Panthallassa and Tethys oceans—climatic zonation, geography, distribution and migration routes of marine and terrestrial life-forms are dramatically simplified.

Modelling studies indicate that the primordial Earth size for the Archaean aeon was approximately 1,700 kilometres in radius and remained relatively static throughout the Archaean to the Late Mesoproterozoic era, increasing by approximately 60 kilometres during 3,000 million years of Earth history. Since the Proterozoic aeon, there has been a steady to rapidly accelerating expansion to the present. The present rate of radial Earth expansion is calculated to be 22 millimetres per year, which equates to a 140 mm/year increase in circumference.

• What about the ocean water and atmosphere?

Researchers have argued that before the Triassic period an ancient Earth with a continuous continental crust would be covered by an ocean with an average depth of 6.3 kilometres. If this were the case, then terrestrial life-forms would not have evolved and continents would have only been exposed to erosion fairly recently in Earth history. However, all continents contain sedimentary rocks dating back to over 3,000 million years ago, and fossilised life-forms dating back to the beginning of the Cambrian period, about 560 million years ago, abound in our museums of natural history.

On an expanding Earth, the ocean water and atmosphere were added at the same time and rate as the sea-floor crust and underlying mantle were added. Modern investigations along active rift zones demonstrate that these, as well as volcanoes, are major sources of new water and gases. The sea-floor crust, ocean water and atmosphere all originate from deep within the Earth's mantle and have been added to the surface crust at an accelerating rate throughout geological time. This increase in new ocean water and atmosphere is considered to have resulted by a process of mantle outgassing, as a natural response to a decrease in mantle temperature and pressure conditions with time.

• What about subduction?

On a constant-radius Earth, sea-floor crust generated along each of the mid-ocean ridges must be disposed of somewhere. Early researchers considered that crust was being subducted around the margins of the Pacific Ocean, and the apparent overriding of the North Pacific Ocean plate by North America and Australia is often quoted as a classic example of plate consumption by subduction. Here, up to 5,000 to 15,000 kilometres of North Pacific Ocean sea-floor crust has supposedly been subducted beneath the North American continent, and the surface area of the Pacific Ocean has supposedly decreased as the Indian, Atlantic and Southern oceans have opened.

The history of the Mesozoic and Cenozoic eras has then supposedly been one of east-west and north-south contraction of ancient Panthallassa and Tethys oceans to the size of the modern Pacific Ocean, subduction of all pre-Mesozoic sea-floor crust, and subduction of a substantial quantity of sea-floor crust generated during the Mesozoic and Cenozoic eras.

Since the introduction of the plate tectonic hypothesis, magnetic mapping of the oceans has revealed that, as well as sea-floor spreading in the Indian, Atlantic, Southern and Arctic oceans, the Pacific Ocean is also undergoing extensive sea-floor spreading, right where subduction around the margins is supposedly taking place (see figure 1). Plate motion measurements

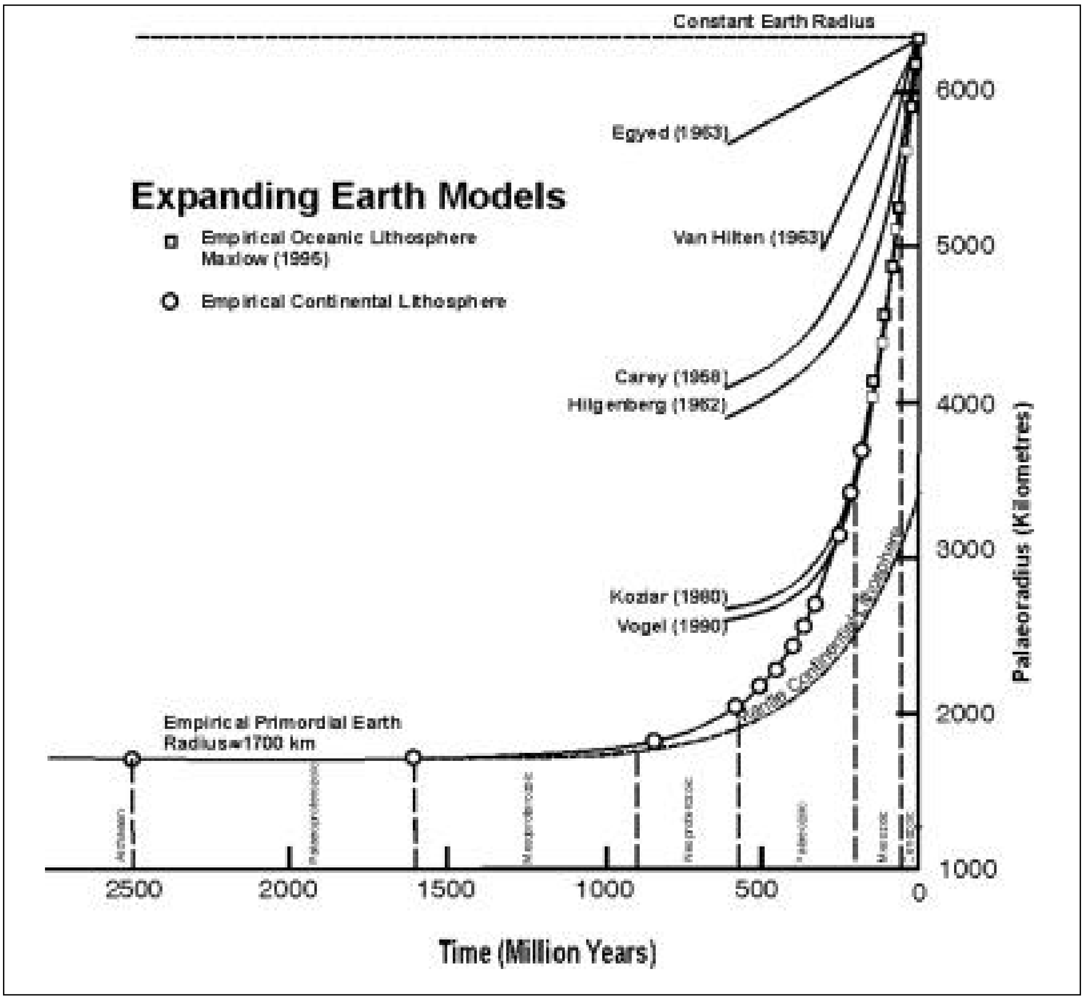

Figure 4. Exponential Earth expansion from the Archaean to the present. Graph shows post-Triassic expansion derived from oceanic mapping and pre-Jurassic expansion derived from an Archaean primordial Earth radius of approximately 1,700 kilometres. Spherical expanding Earth models constructed are shown as filled squares and circles on the graph.

using satellite laser ranging and radio astronomy are now accurate to less than one centimetre. These measurements show that the North American plate is moving west at about 16 mm/year, while the North Pacific plate is moving west-northwest at between 45 and 70 mm/year. The sum of these motion vectors means that the two plates are actually moving apart, not subducting, and the East Pacific mid-ocean-rift zone is extending north along the San Andreas fault (see figure 1).

On an expanding Earth, subduction to the extent that plate tectonics requires does not exist. The values of 22 mm/year, calculated for increase in Earth radius per year, and 140 mm/year for circumference, are adequate to account for all sea-floor growth since the Early Jurassic period, without the need to consider removal of excess sea-floor crust.

• What about orogenesis?

The term *orogeny*, or *orogenesis*, originally meant "the origin of mountains". Since the advent of plate tectonics, orogenesis has come to mean "the folding of rocks in fold belts", not mountain-building. Confusion in the literature persists, however, and it is generally assumed that folding results from continental collision, and collision results in mountain-building. In the real world, mountains are eroded plateaus and are created by vertical movement and modified by erosion.

Researchers have considered that because Earth expansion is a radial process, then orogenesis caused by continental collision, and hence mountain-building, cannot occur. Earth expansion was then discounted because the radial expansion process did not appear to explain the compression required for continental collision, nor the compression required for orogenesis.

On an expanding Earth, orogenesis means "folding of rocks to form fold belts". During expansion, the continental crust must distort, bend, twist and turn to adjust continuously for the change in surface curvature. During this crustal movement there is folding of the soft sediments within sedimentary basins, accompanied by faulting, volcanic intrusion and metamorphism (heating and compression of the rocks), resulting in orogenesis. Once the continents broke up and started to disperse during the Mesozoic era, the edges of the continents started to rise as the interior collapsed during changing surface curvature. Throughout the world today, we now see great escarpment mountains along many of our continental margins, with no need for continental collision, and wide, relatively flat inland plains.

• What about palaeomagnetics?

In palaeomagnetics, measurements of remnant magnetism residing in rocks containing iron minerals are made to determine the ancient latitude of a site sample and the direction to the ancient magnetic pole. These measurements have long been considered the cornerstone of plate tectonics. They are routinely used to determine ancient pole positions to constrain reconstructions of ancient continental assemblages, and have also been used to determine the ancient radius of the Earth. From measurements of the ancient radius, it was concluded that the radius of the Earth has remained constant with time. This conclusion continues to be a key issue in rejecting Earth expansion.

In establishing palaeomagnetics, geophysicists during the early 1960s made a fundamental assumption that the surface area of all continents has remained constant with time, with continental crust being added or removed from around the margins during continental collision or break-up. In determining the ancient Earth radius, palaeomagnetic measurements were taken from sites separated by up to 5,000 kilometres, and it was assumed that the continental crust between the sites had remained constant and stable. Modern plate tectonics now says that continents are made up of fragments randomly accreted during continental assemblage, break-up and dispersal cycles—which makes the conclusions based on ancient radius measurements invalid.

Modelling studies have demonstrated that ancient magnetic poles, determined from palaeomagnetic data, when plotted on expanding Earth models, cluster as diametrically opposed north and south poles. These pole locations show that the ancient North Pole was located in Mongolia to northern China during the Precambrian and Palaeozoic eras, prior to moving north to its present location as the continents migrated south. The ancient South Pole was located in western central Africa throughout the Precambrian and Palaeozoic, prior to moving south to its present location as the continents migrated north.

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• What about space geodetics?

Space geodetics is modern technology that uses VLBI (very long baseline interferometry), SLR (satellite laser ranging), GPS (global positioning systems), DORIS (Doppler orbitography and radiopositioning integrated by satellite) and LLR (lunar laser ranging) to measure the dimensions of the Earth and plate motions of the continents to sub-centimetre accuracy. This technology has determined that the radius of the Earth is increasing by less than 5 ± 3 mm/year, or in other words is shown to be "constant". This effectively replaces palaeomagnetics as the main argument against Earth expansion.

In order to determine Earth radius using VLBI, two or more ground stations are used to determine Earth parameters in relation to a very accurate celestial reference frame. These measurements are then converted to an international terrestrial reference frame and used with measurements using satellite technology to calculate a global solution. The limitations to all methods, and VLBI in particular, are atmospheric interference and, for the satellite methods, the use of the physical constants G (universal gravitation) and M (Earth mass) to tie orbital parameters to the centre of the Earth.

When enough VLBI ground stations were established to form a global network during the early 1990s, it was found that the global excess in radius was 18 mm/year (Robaudo & Harrison, 1993). This value was considered to be extremely high when compared to expected deglaciation rates, estimated at less than 10 mm/year.

Robaudo and Harrison in fact "expected that most VLBI stations will have up-down motions of only a few mm/yr" and recommended that the vertical motion be "restricted to zero, because this is closer to the true situation than an average motion of 18 mm/yr" (Robaudo & Harrison, 1993, p. 54). This recommendation is now reflected in current solutions to the global network where global solutions are effectively constrained to zero.

The recommendations of Robaudo and Harrison are justified from a plate tectonic perspective. The 18 mm/year excess was considered to be an error in atmospheric correction, so was simply adjusted accordingly. What must be appreciated is that without an acknowledgment of a potential increase in Earth radius, NASA had no option but to correct this value to zero and hence adopt a static Earth radius premise. From an expanding Earth point of view, however, the 18 mm/year excess equates with the 22 mm/year required for Earth expansion, determined from measurements of areas of sea-floor spreading.

In order to accept Global Expansion Tectonics as a viable global tectonic process, we must be prepared, however, to remove the "blinkers of dogma" so prevalent in our learned institutions, in order to encourage active research into alternatives to accepted global tectonics.

A VIABLE GLOBAL TECTONICS EXPLANATION

While the cause of Earth expansion remains a speculative issue, in time this will be resolved by dedicated research. The geophysical objections to Earth expansion outlined above can only be resolved by an acceptance of the potential for expansion and adequate scientific resolution. The only limitations to Earth expansion relate to limitations in technical ability to display global-scale geological and geophysical information in an interactive 4-D spherical format, and I am sure there are wise and wonderful people out there who are more than capable of doing that.

By using the published oceanic and continental geological mapping shown in the *Geological Map of the World* (CGMW & UNESCO,1990), the process of Earth expansion from the Archaean aeon to the present can now be accurately constrained. This in itself quantifies Earth expansion. By creating models from this mapping, the expansion process can be readily visualised throughout Earth history. The ancient Earth was shown to undergo a steady expansion throughout the Archaean and Proterozoic, prior to a rapidly accelerating expansion during the Palaeozoic era, and continental break-up and dispersal during the Mesozoic and Cenozoic eras to the present.

Readily available geophysical and geological data plotted on each of the models demonstrates that the ancient equator, determined from the ancient pole positions, agrees in principle with plate tectonic locations using palaeomagnetic and climatic data. Ancient polar ice-caps, limestone reefs, coal deposits, vegetation patterns, and marine and terrestrial life-forms all coincide with the ancient equator and pole positions throughout Earth history. This coincidence is an impossibility on an Earth of constant radius.

This modern geological and geophysical data can now be used to accurately quantify Earth expansion, making the evidence for expansion very favourable.

In order to accept Global Expansion Tectonics as a viable global tectonic process, we must be prepared, however, to remove the "blinkers of dogma" so prevalent in our learned institutions, in order to encourage active research into alternatives to accepted global tectonics. ∞

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